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DRAWINGS ATTACHED.

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COMPLETE SPECIFICATION.

Liquid Dispensing Machine.

We, SAPOLIN PAINTS, INC., a Corporation organized under the laws of the State of New York, of 183 Lorraine Street, Brooklyn, New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to liquid dispensing machines and more particularly to machines for dispensing preselected quantities of a preselected colorant or colorants into a known amount of paint to produce a predetermined color.

It has been common practice for paint manufacturers to produce a number of different colors or shades of ready-mixed paints. The ready-mixed paint of each color is packaged in suitable containers, usually of gallon capacity or multiple gallon capacity or fraction of gallon capacity, such as quarters, pints, half pints, etc. This requires that the paint retailer, the jobber and the manufacturer carry large inventories of the various colors of paint. According to that practice, the paint is mixed to desired color at the manufacturing plant and then supplied as such in individual containers of each color through the customary channels to the retailer. According to another system practiced on a wide scale, the retailer carries only a limited number of colors of paint and is supplied with colorants, usually in compressible tubes, which may be manually added to a given amount of base paint in accordance with previously worked out formulas and charts to produce a wide range of colors of paint. For example, by starting with a gallon of a particular base color paint such as white, or some other standard base color, the retailer may add a certain predetermined quantity of a selected colorant to it and, when mixed with the base paint, this produces a paint of a predetermined color. By varying the amount of color with a preselected base paint, according to formulas previously worked out, the retailer is enabled to supply colors of paint over a wide range of colors and shades without the necessity of carrying in stock a large number of different colors of ready-mixed paint.

This invention provides a machine which, on a predetermined presetting of the machine, will automatically deliver to a receiving vessel a predetermined amount of colorant, from a suitable source of different colorants, to be mixed with a predetermined amount of paint of a standard base color to produce a mixed paint of predetermined desired color. And, in accordance with previously worked out formulas and charts, it is possible to produce, and reproduce in matching color, a wide range of different colors and shades of mixed paint from a supply of a small number of different colors of base paints and a small number of base colorants, thus eliminating the necessity of the large inventory that would be required if each different color and shade of paint is carried in stock. In brief, the invention makes available to the retailer a machine which permits him to provide paints which are custom-blend to the desired colors to suit the individual tastes of individual customers and in a way that may be accurately duplicated; and, this may be done in accordance with previously worked out formulas and color charts.

Paint may be defined generally as a pigmented liquid composition which is converted to an opaque solid film after application as a thin layer. There are, of course, various kinds of paint, such as, oil paints,

alkyd paints, latex paints enamels of various kinds, etc. Suffice it to say that this invention is adapted for use in connection with all the various kinds of paint wherein a colorant is mixed with a base paint or vehicle to impart color to the mixed paint. And it will be understood as used herein that a "standard base" paint is to be considered as one having a standardized color, such as, white or some other predetermined standardized color; and, "base," or "basic," colorant is to be considered as a flowable pigmented coloring composition which is of a predetermined standardized composition and color, and may be mixed with a standard base paint to provide a mixed paint of a color or shade, different from the base paint with which it is mixed.

According to the present invention there is provided a paint colorant dispensing machine which comprises a framework, an array of stationary colorant supply vessels mounted on said framework, a separate gear pump connected to each of said supply vessels, each gear pump having an intake connected with the interior of its supply vessel and a discharge outlet to which is connected a flexible delivery conduit from which colorant from that supply vessel is delivered, a rotatable pump drive shaft connected to each of said gear pumps, each of said gear pumps delivering a predetermined, fixed amount of colorant through its flexible delivery conduit for each equal angle of rotation of said drive pump shafts, and means to rotate all of said pump drive shafts in unison so that when any one of said gear pumps is rotated, colorant is simultaneously pumped through all of said conduits, said conduits providing an array of flexible conduits and each conduit having a delivery nozzle normally positioned to return colorant to the supply vessel to which its pump is connected so that colorant pumped from each supply vessel will be circulated and returned to that supply vessel when that nozzle is in normal position, said conduits being sufficiently flexible to permit any selected conduit of said array of conduits to be manually moved from its normal position to place its delivery nozzle for delivery of colorant from that conduit into a receiving vessel during the operation of said pumps while the colorant in each of said other supply vessels is simultaneously agitated by circulation of the colorant contained therein through its pump and flexible conduit.

In a form of the present invention, there is provided a plurality of stationary colorant storage or supply vessels arranged adjacent to each other on a suitable supporting frame or structure which may have means to support a receiving vessel, such as a standard paint can. Each colorant storage vessel is provided with a pump, which takes suction from the source of supply of colorant stored in the vessel to which it is connected. Connected to the discharge side of each pump is a discharge conduit having a delivery nozzle at its free end which normally rests within the same storage vessel to which its pump is connected, but inasmuch as the discharge conduit may be of flexible material, the delivery nozzle of any one or more of the plurality of flexible conduits may be removed from its normal position in its storage vessel and placed to deliver colorant, pumped from its storage vessel, by its pump through its discharge conduit, into a suitable receiving vessel which may be a paint containing a standard quantity of a base paint that is to be blended and mixed with the added colorant.

Each of the plurality of colorant pumps, one for each of the plurality of colorant supply vessels, is connected with a common driving means which, in turn, is driven by a single prime mover which is preferably an electric motor, mounted on the frame. The pump driving means is connected with a driving mechanism, including a push rod, which operates a rotatable ratchet wheel when the prime mover is in operation. The ratchet wheel carries a numerically divided index scale which moves with the ratchet wheel relatively to a fixed or stationary index. The ratchet wheel has secured thereto a cam-shaped finger which operates, or throws, an electric switch when the index scale is moved to a position where the zero (0) point registers with the stationary index. The cam-operated switch is connected in the electric power line to the electric driving motor and the arrangement is such that on setting the index scale to a predetermined position and the electric motor is operated to drive the pumps, the ratchet wheel is rotated in response to movement of the motor, which also at the same time operates the pumps. When the index scale, associated with the ratchet wheel, reaches zero (0) position, the ratchet wheel cam finger throws the cam-operated switch. This cuts off the current supply to the motor and causes the entire machine to stop operation and hence any further pumping action. The amount of colorant delivered by the pumps is calibrated with the movement of the ratchet wheel and also the index scale, so that for any given setting of the index scale, a predetermined amount of colorant will be delivered through each of the flexible delivery conduits. The colorant passing through each of the conduits is merely circulated and returned to its storage vessel if its conduit is resting in normal position with its delivery nozzle in its vessel, but any particular colorant in the preset amount may be delivered into the receiving vessel containing the base paint by merely placing the particular flexible conduit with its de-

livery nozzle into the receiving vessel at the outset of the cycle of operation.

In the following more detailed description reference is made to the accompanying drawings, in which:—

Fig. 1 is a top plan view of a machine embodying the invention with certain parts broken away, better to show the construction;

Fig. 2 is a view in elevation, partly in section, of the machine shown in Fig. 1;

Fig. 3 is a view in section, on line 3—3 of Fig. 1, showing a typical colorant supply vessel with its drive means, pump and flexible discharge conduit;

Fig. 4 is a view in elevation, on line 4—4 of Fig. 1, and partly in section showing a receiving vessel, in this instance a conventional paint can with the delivery nozzle of a colorant discharge conduit within the can;

Fig. 5 is a plan view partly broken away showing a part of the pump driving mechanism, and the reciprocating drive rod and ratchet wheel driving mechanism in fully retracted position;

Fig. 6 is a partial plan view of the ratchet wheel driving mechanism at the beginning of a stroke of the reciprocating drive rod;

Fig. 7 is a view in section to larger scale showing the manner of mounting the gear pump to a colorant supply vessel;

Fig. 8 is a view on line 8—8 of Fig. 5;

Fig. 9 is a view on line 9—9 of Fig. 5; and

Fig. 10 is a wiring diagram showing the electric circuit for connecting the machine and operating parts.

Referring now to the drawings, in which like reference characters indicate like parts throughout the several views, the machine, as shown, comprises an array of stationary colorant storage or supply containers 10*a* to 10*k*, arranged in a circle and mounted on a horizontally disposed upper plate 11 mounted on suitable spacer supports 12 and a closure housing 13 comprising a side wall 14 of generally cylindrical shape, a front panel 15 and a base plate 16. It will be understood that the housing may be of any design and preferably is artistic in nature in order to lend aesthetic appeal so that the machine when placed in a retail store, for example, will serve not only its utilitarian purpose as a paint colorant dispenser and blender but also as an attractive and eye-catching display piece.

As shown, there are eleven colorant supply vessels 10 (*a* to *k*), one for each separate color or colorant that is to be used in the machine. But it will be understood that a greater or lesser number may be provided, and this will be determined by the system that is worked out for the color-blending system that is to be employed.

Each colorant supply vessel 10 is constructed and mounted in the same way, so it will suffice to describe in detail only one typical colorant supply vessel 10 (see Fig. 3). It comprises a cylindrically shaped vessel 10 of suitable material, and, as shown, is stainless steel. It has a cylindrical side wall 20, a removable cover 21 and a bottom wall 22. The body portion, comprising side wall 20 and bottom wall 22, is mounted in the upper plate 11 of the main frame of the machine. A pump 24 (see Figs. 2, 3, 7) is mounted to take suction from a source of supply of colorant 25 through intake conduit 26 having its outer end mounted through a leak-proof connection 27 to a suitable outlet aperture 28 in the bottom wall of the vessel 10. The pump 24, as shown, is a gear pump, of known construction and suitably modified to be mounted in leakproof fashion with a rotatable drive shaft 29, long enough to extend through appropriate holes in the bottom wall 22 and cover 21, with its upper free end portion 30 extending vertically above the cover 21 and consequently above the main plate 11. It will be seen that the rotatable pump drive shaft 29 extends through the liquid colorant 25 and is provided with a stirrer, in the form of a bent rod 31, fixed to sleeve 32 which may be adjustably secured and clamped to the pump shaft 29.

The gear pump 24 (see Fig. 7) comprises a pair of meshing impeller gears 33, 34, mounted in a housing 35 in conventional fashion; the drive shaft 29 of the pump being secured to gear 34 which it drives. The pump housing 35 has an outwardly extending hollow externally threaded boss 36 through which the shaft 29 extends. A packing chamber 37 is provided with a packing gasket 39 and a sleeve follower 38. The threaded boss 36 is provided with an internally threaded ring 40 forming an annular shoulder 41 upon which rests a ring packing material 42. A packing-gland cap 43 has an internally threaded cylindrical side wall 44 and a top wall 45 having an aperture 46 therein through which the shaft 29 extends. It will be seen that this provides means for mounting the gear pump 24 to the colorant vessel 10 and leakage from the vessel to the outside of the pump is prevented by packing 41 and a conventional packing gland 37, 38, 39 for the pump shaft is provided.

The suction side of the pump is connected to the source of supply of colorant in the vessel 10 through suction pipe 26 which is threaded at its outer end. The threaded portion 49 extends through an aperture in the bottom wall 22. The threaded portion is provided with a threaded ring 50 providing a shoulder on which rests a packing ring 51 under the wall 22. A threaded clamping ring 52 holds the suction pipe 26 in place and a leakproof joint is provided.

The discharge port of the pump 24 is connected to a flexible discharge conduit tube

53 (see Fig. 3) which extends from the pump, mounted beneath the vessel 10, upwardly through a suitable aperture 54 in the main plate 11. The flexible discharge tube 53, as shown, is made of polyvinyl chloride plastic, which is transparent, so that liquid colorant in the tube will show through. This is a utilitarian advantage, but as well, it presents a pleasing color effect when each of the colorant vessels is charged with a colorant different from the others. The outer free end portion of the flexible discharge tube 53 is provided with a delivery nozzle 55 which will not dribble colorant from the tube once the pump 24 is stopped after a pumping operation. The free end portion of the tube 53 normally is in the position shown in Fig. 3 with the nozzle 55 extending downwardly into an upstanding hollow neck portion 56 on the cover 21 of the vessel 10. The outer portion of the tube is provided with a disc 57, sealed to the tube. Preferably, this is a magnetized metal disc 57 which serves as a close-fitting cover over the upper end of the neck 56; the magnetized disc adhering to the neck with sufficient force to hold it in place under normal operating conditions but permitting the manual lifting of the outer end of the tube 53 out of the neck 56. If desired, a stopper of suitable yieldable material, insertable into the mouth of neck 56 may be used instead of the magnetic disc 57. In some instances it may be desirable to place a helical metal spring 58 around the flexible tube 53 over its full exposed length, but this is not used in our preferred embodiment. Also, in some instances it may be desirable to mount the pump 24 inside the supply vessel 10 in its bottom portion, in which case it is wholly immersed in a bath of colorant.

The upper end of the pump drive shaft is provided with a sprocket gear 47, the hub 48 of which is secured to the shaft by a set screw 49. Hence, the sprocket gear 47 may be secured to the pump shaft in any random angular position. Referring now to Fig. 1 the sprockets 47 for each of the eleven vessels 10 (*a* to *k*) are indicated respectively by reference numerals 47 (*a* to *k*). And it will be understood that all of the colorant supply vessels 10 (*a* to *k*) are of the same construction.

It will be seen, as shown clearly in Fig. 1, and 2, that the gear pumps 24 (*a* to *k*) (not all of which are seen in these Figures) are arranged with their discharge ports extending in a substantially radial direction toward the common center of the array of colorant vessels 10 (*a* to *k*). Trainel over the respective sprocket gears 47 (*a* to *k*) is an endless sprocket drive chain 60 which is also trained over an idler sprocket gear 61 (later described) and a drive sprocket gear 62, which is secured to the upper end of a main drive shaft 63, driven through a speed reducer 64, connected to the drive shaft of an electric motor 65, serving as a prime mover. The motor 65 and speed reducer 64 may be mounted on the frame in any suitable way, as by brackets 66. The motor is connected in an electrical circuit, described in detail hereinafter.

Mounted above the main plate 11 is a horizontally disposed housing cover plate 70, supported on a side wall rim 71, it being noted that the main plate 11 and its overlying housing cover plate 70 jut out from the main body of the housing at what may be conveniently referred to as the front or face of the machine. The necks 56 (*a* to *k*) extending upwardly from the cover 21 of the colorant supply vessels 10 (*a* to *k*), extend through suitable apertures in the cover plate 70 and terminate a short distance above this plate. The flexible conduits 53 (*a* to *k*) pass through apertures in cover plate 70, above the corresponding apertures 54 (*a* to *k*) in the main plate 11.

The vertically extending rotatable drive shaft 63, which is driven through the speed reducer 64 by motor 65, also has secured to it a star wheel 72, having a plurality of cam teeth 73, 74, 75, 76, 77, 78 (see Fig. 5). As shown, the star wheel 72 has six cam teeth and the sprocket gear 62 has eighteen teeth, for a purpose described later on. The star wheel 72 is secured to the drive shaft 63 and is positioned below the sprocket drive gear 62 (see Figs. 2 and 8) in a plane just above a small bed plate 80, mounted on main plate 11. The sprocket drive gear 62 is shown in dotted lines in Fig. 5 to indicate that it is mounted on the shaft 63 above the star wheel 72.

The idler sprocket 62 is mounted on a shaft 81, in turn, mounted on an adjustable bracket 82 (see Fig. 5) which is adjustably secured to the bed plate 80 by means of a stud bolt 83 which extends through a slot 84 in the bracket 82. It will be seen in Fig. 5 that the tension on sprocket chain 60 may be adjusted by moving the sprocket 61 toward or away from the sprocket chain 60 by moving the slotted bracket 82 on the bolt 83 which may be tightened to clamp the bracket in any desired adjusted position to eliminate any undue play in the drive chain. Now it will be seen that, when motor 65 is operated, the drive shaft 63, and hence drive gear 62 and star wheel 72 are rotated. Inasmuch as drive chain 60 is trained over all of the sprockets 47 on the respective pump shafts, all of the pumps are driven at the same time and speed, in unison. As shown, each of the sprocket gears 47 (*a* to *k*) has sixteen teeth and drive gear 62 has eighteen teeth. The star wheel 72 has six cam teeth, for reasons explained in further detail later on.

Mounted in the central area of the cover plate 70 is an upstanding hollow sleeve 85

(see Figs. 2 and 4) into which fits a rotatable vertically adjustable bracket leg 86. From this leg extends a horizontally disposed, flat, metallic bracket arm 87. The bracket arm 87 has depending therefrom a slotted guide plate 88 having a slot 89 adapted to fit over the upper edge of a conventional paint can 90, to maintain the bracket arm positioned over the open end of the paint can, when colorant is being delivered to the can. The arm 87 is provided with one or more apertures 91, 92, through which the free end portion and nozzle 55 of any one of the flexible conduits 53 (*a* to *k*) may be inserted, so that colorant delivered from the nozzle 55 will be delivered into the paint can 90, or into any other suitable receiving vessel, which may be placed on the housing cover plate 70 under the bracket arm 87. As noted, the bracket arm 87 may be raised and lowered and swung out of the way of the receiving vessel 90. The magnetic disc 57, in contact with metal arm 87 having magnetic properties, will hold the nozzle 55 of the flexible conduit in proper delivery position, when it is desired to pump any given colorant, from any given supply vessel, through its flexible discharge conduit 53 into the receiving vessel 90. It will be understood, of course, that the discharge conduits 53 (*a* to *k*) being flexible, any of them may be manually removed from their normal resting places, as shown in full lines in Fig. 2 and, placed in the receiving vessel 90—as shown in dotted lines.

In the machine, as shown, each gear pump 24 (*a* to *k*) delivers the same quantity per revolution of the pumps. The pumps are conventional gear pumps, modified as indicated, and they have been calibrated. That is, by experiment it was found that the pumps each deliver a constant amount of colorant liquid per revolution. The pumps, as shown, deliver $^1/_6$ fluid ounce per revolution. Hence, in the machine, as shown, a pump 24 will deliver from nozzle 55 one thirty-second ($^1/_{32}$) of a fluid ounce for each $67\frac{1}{2}°$ of angular rotation of the pump shaft 29. Thus, if the sprocket gears 47 (*a* to *k*) have sixteen teeth, as shown, in the drawings which represent a preferred embodiment then for each three-tooth angular movement of a sprocket gear 47, the pump 24 will rotate $67\frac{1}{2}°$ and will deliver one thirty-second ($^1/_{32}$) of a fluid ounce of colorant through the discharge conduit 53. For convenience of description this amount of liquid colorant is herein designated as one " volume count " of colorant.

The machine may be operated by hand, if desired, and the pump shafts rotated through sufficient angle of rotation to deliver from a discharge conduit a predetermined quantity of liquid colorant from its supply vessel. However, a preferred embodiment is operated by a motor and mechanism is provided which can be preset so that when the machine is operated by power, it will automatically deliver the number of " volume counts " of colorant (in this instance a " volume count " represents $^1/_{32}$ fluid ounce) for which the machine is preset at the beginning of a cycle and when that number of counts of colorant have beent delivered by the pumps 24, the machine automatically shuts itself off and will not further operate until a new cycle is manually initiated.

The counting, indexing and shut-off mechanism comprises, in general, a reciprocatable drive rod 95 mounted to reciprocate in response to rotation of star wheel 72, in a guideway 96 mounted on bed plate 80, the drive rod 95 engaging and driving a ratchet wheel 97 (herein sometimes called a " counter wheel ") a given amount for each forward stroke of the drive rod 95. The ratchet wheel 97 has fixed thereto at its periphery a cam finger 98 adapted to engage a micro-switch 99 when the ratchet wheel 97 is rotated a given amount. This micro-switch is designed to shut off the current to the electric motor 65 when the cam finger 98 engages the switch stem 100 of the micro-switch, otherwise the micro-switch is normally " on ". As shown in the drawings, the sprocket drive gear 62 has eighteen teeth and the star wheel 72 has six cam teeth. Hence, on each three-tooth angular movement of sprocket gear 62, a cam tooth will move the same angular distance. Also, since the sprocket drive chain 60 is trained over the pump sprocket gears 47 (*a* to *k*), each of these gears will rotate angularly by three teeth in response to a three-tooth movement (angular distance) of the drive gear 63. And inasmuch as each three-tooth movement of sprockets 47 results in an angular movement of the pump shafts 29 of $67\frac{1}{2}°$, the pumps will each deliver one thirty-second ($^1/_{32}$) of a fluid ounce of colorant for each three-tooth movement of sprocket 62, or for each single cam tooth movement of star wheel 72. The star wheel 72 is so designed that for each three-tooth movement of the gear 62 (see Figs. 5 and 8) a cam tooth of the star wheel 72 will engage the inner end 106 of the reciprocatable drive rod 95 and move it forward one stroke, after which it is returned to retracted position ready to be moved in another forward stroke by the next succeeding cam tooth of the star wheel.

The bed plate 80 is secured to the frame, and, as shown, is mounted on the upper base plate 11. The guideway for the reciprocating drive rod 95 comprises a pair of guide bars, 101, 102, mounted in parallel spaced relation on the bed plate 80. A pair of bridge plates 103, 104, provide spacers and are held in place by means of screws 105. The inner end of the drive rod has an upward bent portion 106, providing a contact shoulder for engagement with the cam teeth

of the star wheel 72. The outer end of rod 95 has a pawl member 107 pivotally mounted thereto on its upper surface, by a pivot pin 108. This pawl 107 has a pointed dog 109 adapted to ride on the periphery of the ratchet wheel 96 and engage its teeth 110. The pivoted pawl member 107 is spring-biased by a first helical tension spring 111 staked at one end to pivot pin 108 secured to the arm 95 and at its other end to a stake 112 secured to the guideway bridge 103. This spring urges the drive rod 95 and hence pawl 107 toward its retracted position; that is, toward the star wheel 72. The pawl 107, pivoted at 108, is also provided with a second stake 113, a distance from the pivot pin 108. Secured to this stake 113 is a second helical spring 114 of less strength than spring 111, the other end of which is fixed to a stake 115 secured to bridge plate 103. This spring 114 urges the pawl 107 to rotate about pivot 108 so that the bevelled rear edge 127 of the pawl will abut the front edge 128 of bridge plate 104, but the spring 114 is sufficiently yieldable to permit the pawl to rotate about pivot 108 so that the dog 109 will be at rest beyond the teeth 110 of the ratchet wheel when the rod 95 is retracted by spring 111. The spring 111 causes pawl 107 to rotate about pivot 108 in a counterclockwise direction until the bevel edge on pawl 107 lines up with face 128 of bridge 104.

Referring to Figs. 5, 8 and 9 and more particularly to Fig. 6 it will be seen that when the drive rod 95 (herein sometimes referred to as a push rod) begins its forward stroke from retracted position, it is pushed by a cam tooth on the rotating star wheel 72. Pivot pin 108 which is secured to push rod 95 and which extends through pawl 107 pushes the pawl and stretches spring 111 which is anchored to pivot pin 108 and fixed stake 112. As the forward stroke continues and after the bevel edge 127 (see Fig. 6) moves slightly away from the end 128 of fixed bridge 104, the minor spring 114 pulls on stake 113 fixed to the pawl 107. This causes pawl 107 to rotate clockwise slightly about pivot 108 with the result that dog 109 enters into the root of the tooth between edges 138 and 139. The pawl cannot move further about pivot 108 because the dog 109 engages the root of the teeth on ratchet wheel 97. Then, as the push rod 95 continues in its forward stroke by being pushed by a cam tooth on star wheel 72, the dog 109 rotates the ratchet wheel 97 in a clockwise direction. At the end of the forward stroke of push rod 95, (that is when the cam tooth on star wheel 72, as it rotates, passes out of engagement with the shoulder 106 of the push rod 95), the spring 111 draws the push rod 95 in a rearward stroke until the shoulder 106 of push rod 95 is engaged by the next oncoming cam tooth of star wheel 72. When the push rod 95 begins its rearward stroke the bevelled edge 127 of pawl 107 permits the pawl to rotate slightly in counterclockwise direction about pivot 108 because the spring 114 is weaker than spring 111. This slight counterclockwise rotation of pawl 107 moves the dog 139 out of range of the crests of the teeth on ratchet wheel 97, while the push rod is being moved in its rearward stroke by spring 111. After the rearward stroke is completed and slightly after push rod 95 begins its forward stroke, by being pushed by the oncoming cam tooth of the rotating star wheel 72, pivot pin 108 pushes the pawl forwardly and the spring 114 then causes the pawl to rotate clockwise about pivot 108 until the dog 109 enters the root of the next successive tooth on ratchet wheel 97. Then as the push rod continues its forward stroke, the dog 109 rotates the ratchet wheel 97 clockwise an amount corresponding to the forward stroke of push rod 95. It may be noted also that when the push rod reaches the end of its rearward stroke the bevelled edge 127 of pawl 107 abuts against the bridge 104 which serves as a stop. Meanwhile, the dominant pawl 122, as explained herein, holds the ratchet wheel in fixed position and any counterclockwise movement that might otherwise ensue from the action of the dog 109 of pawl 107 riding up over the ratchet teeth on the rearward stroke of the push rod 95 is effectively prevented.

The ratchet wheel 97 is fixed to a vertical stud shaft 116 mounted for rotation on bed plate 80. The ratchet wheel is provided with a large number of uniform ratchet teeth 110, each of which, as explained later, represents one "count" of liquid colorant. This ratchet wheel has mounted at its periphery a cam finger 98, which is a part of cam bracket or plate 117. This plate 117 is provided with a pair of slots, through which extend clamping screws 120, 121. The screws are screwed into suitable threaded holes in ratchet wheel 97 to clamp the plate 117 in desired position, the slots 118, 119 providing means for adjusting the position of cam finger 98, so that it will trip the micro-switch 99 at a precise and predetermined angular position of the ratchet wheel.

Mounted on the bed plate 80 is a second pawl 122. This pawl is L-shaped (as best seen in Fig. 5). It is pivoted between its ends at the apex of the L on a pivot pin 123 fixed to the bed plate. One end is provided with a pointed dog 124 which rides on and engages teeth 110 of the ratchet wheel. The other end of the lever pawl 122 is provided with a stake 125 to which is anchored one end of a helical tension spring 126. The other end of spring 126 is anchored to stake 115 fixed to the bridge plate 103. This pawl 122, for convenience of description, is herein designated the "dominant" pawl because it

has a strong spring 126 which rotates ratchet wheel 97 until dog 124 is at absolute base of any given tooth. And furthermore it serves the function of assuring that the ratchet wheel is firmly held without rotation, at the end of a stroke of drive arm 95 and that for each stroke of the arm 95, the counting mechanism will operate uniformly for each angular movement of the ratchet wheel 97.

The shaft 116, to which ratchet wheel 97 is fixed, extends upwardly through cover plate 70. It has fixed thereto, at its upper end, and index hand wheel, or disc, 129 which carries a numerically divided scale 130 at its periphery. This scale 130 co-operates with a fixed index 131 on the cover plate 70. The scale 130 is divided to have an index division for each tooth on ratchet wheel 97 and each division represents a "volume count" of colorant. Bearing in mind that each tooth of the ratchet wheel represents one count volume of colorant, the ratchet wheel and index disc are designed to be set so that the machine will accommodate itself to deliver any desired amount of colorant from one count up to a sufficient number of counts to cover a very wide range of color blends.

The electrical circuit for the machine is shown diagrammatically in Fig. 10. A holding circuit is used to permit the presetting of the number of volume counts of colorant that are desired to be delivered. This presetting places the power-disconnect-micro-switch in the "on" position. By actuating a start switch, a relay is brought into operative position and stays in operative position until the reciprocating push rod rotates the ratchet wheel and index scale to zero position. In this zero position the cam 98 on the ratchet wheel engages the micro-switch and throws it to "off" position. This cuts off the current to the motor, which is the prime mover, and hence stops the pumps from any further pumping action and also cuts out the relay so that the motor and pumps will not again operate until the counting mechanism is preset and the start switch is actuated.

Referring now to the wiring diagram of Fig. 10, 140 represents a source of electric power. The negative side is connected by a line 141 through a line 143 to electric motor 65. The positive side of the electric power current is connected to line 144 through a main switch 142, (which may be a snap-on, snap-off switch, see 142, Fig. 1) through micro-switch 99, which is normally in "on" position when cam 98 is in any position other than zero. A lamp 145 connected across lines 143 and 144 will glow when switch 142 is "on" to indicate that the main current supply to the machine is "on". If desired, this switch may be left on at all times to light up any advertising display, or the like. The other side of micro-switch 99 is connected through line 146 to one side of a solenoid operated switch 147; the other side of switch 147 being connected by a line 148, through a key operated switch 160, through starter switch 150 through line 149 to line 146 (see Figs. 10 and 1). Line 143 is connected by line 151 to solenoid coil 152, the other side of which is connected by line 153 to line 148. Line 144 is connected through line 154 to solenoid operated switch 155, the other side of which is connected by line 156 to motor 65. A line 157 connected to line 156 through lamp 159, through line 158, is connected to line 143, which in turn is connected to the other side of the motor 65 (see Figs. 10 and 1).

Operation.

The machine operates as follows: Assume that each of the colorant supply vessels is charged with a different base color colorant and the machine has been operated to circulate colorants and fill all discharge conduits, and it is desired to deliver a predetermined amount of colorant. There are, as shown, eleven supply vessels and the colorants may, for convenience of description, be designated A to K to correspond with the reference numerals 10 (*a* to *k*). Assume that it is desired to deliver twenty-five volume counts of colorant A to be mixed and blended with a gallon of a standard base white, to produce a predetermined color of mixed paint. A standard gallon can of the standard base white paint with lid removed is placed on the platform provided by housing cover 70, beneath bracket arm 87. It will be understood that all nozzles 55 of delivery conduits are in their normal position, as shown in Fig. 3. If colorant A is to be delivered to the can 90, then flexible conduit 53*a* is placed with its nozzle in the can.

The main switch 142 is turned "on". Switches 147 and 155 are off, so no current can pass to the motor 65. Lamp 159 is "off" and starter switch 150 is "off". Micro-switch 99 is normally "on" except when index wheel is at 0 (zero).

Index wheel 129 is rotated clockwise until the division on scale 130 representing the number of volume counts (a count being in this instance $^1/_{32}$ fluid ounce) that the operator wishes to be delivered to the gallon of white base paint in can 90 (see Figs. 1 and 2). Assuming twenty-five volume counts are desired, the division number "25" on scale 130 is set on the fixed index 131 on cover plate 70 by rotation of index hand wheel 129. This will bring the angular position of ratchet wheel 97 to a position corresponding to this setting, since the index wheel and ratchet wheel are fixed to a common shaft 116. The dominant pawl 122 with its pointed dog 124 in the valley between the ratchet teeth will hold the ratchet wheel

firmly and in a position where there is no appreciable play.

Having set the scale to the division " 25 ", the delivery conduit 53*a* is removed from supply vessel 10*a* (if it has not theretofore been done) and its nozzle 55*a* is inserted through the appropriate aperture 91 in bracket arm 87 with the nozzle extending into can 90. The remaining delivery conduits 53 (*b* to *k*) are left in normal resting position with their nozzles in their respective supply vessels. The index dial and ratchet wheel having thus been preset to deliver twenty-five volume counts of colorant, the machine is now set and ready for a cycle of operation. The starter switch 150 is turned " on ". This immediately passes current through switch 142 (previously turned on), line 144, microswitch 99 (normally " on "), line 146, switch 150, key operated switch 160, line 148, line 153, through solenoid 152, line 151, line 143, line 141, back to the source 140. Thus the solenoid 152 is energized and this closes switches 147 and 155. Immediately current will flow through switch 99, line 146, switch 147, line 153, coil 152, line 151, line 143 and line 141 to the source. Thus switch 147 takes over the duty of switch 150 and sustains energization of coil 152 even though switch 150 is released to open position. Consequently switches 147 and 155 continue closed. The closed switch 155 causes flow of current through line 144, line 154, through switch 155, line 156 to motor 65 and through the motor, line 143, and line 141 back to the source and hence the motor begins operation. In the meantime current flows through lines 157, lamp 159, line 158, line 143, line 141 to the source and the golwing lamp 159 is an indicator to show that the motor is running.

The operation of motor 65 causes the main drive shaft 63 (from speed reducer 64) to rotate. This causes rotation of main drive sprocket gear 62, which in turn drives sprocket chain 60. This causes rotation of all of the pump shafts 29 (*a* to *k*) with consequent operation of gear pumps 24 (*a* to *k*). Hence, colorant is pumped from each of the colorant vessels 10 (*a* to *k*) through their respective delivery conduits 53 (*a* to *k*). The colorants in all of said vessels are merely circulated back to their respective supply vessels, since all but delivery conduit 53*a* is in normal resting position. But the colorant pumped through conduit 53*a* is delivered into the receiving can 90, since the nozzle was placed there before the beginning of the pumping cycle. This circulation of the colorant, together with stirring action of stirrer 31, every time the machine is operated assures that the colorants will be uniformly mixed and the closed supply vessels provide substantially air-tight storage for the colorant and unwanted " skin " formation on the colorants is eliminated.

While the motor 65 is running and the drive sprocket gear 62 is rotating, the star wheel 72 fixed to the same drive shaft is rotating with the sprocket 62. There are six cam teeth on the star wheel 72 and eighteen teeth on the sprocket gear 62. Hence, for each three teeth angular movement of sprocket 62, the star wheel moves angularly the equivalent of one cam tooth. At the beginning of a pumping cycle the reciprocatable drive rod 95 is in retracted position. In this position the shoulder 106 of drive rod 95 is in abutting engagement with a cam tooth on star wheel 72 and the point of dog 109 of pivoted pawl 107 is withdrawn but in angular line with a valley between ratchet teeth 110, as shown in full lines in Fig. 5. Also, the point of dog 124 of dominant pawl 122 is in a valley between ratchet teeth as shown in full lines in Fig. 6; it being noted here that pawl 122 serves as a holding or locking pawl to hold ratchet wheel firmly from any rotation during the rearward or retracting stroke of drive rod 95 and its pawl 107.

The drive rod 95 being in retracted position with its shoulder 106 in engagement with a cam tooth of star wheel 72 is now moved forward in guideway 96, by the continued rotation of the star wheel. The drive rod with the point of dog 109 of pawl 107 pushing against the substantially radial short edge 139 of the ratchet tooth 110 causes corresponding rotation of the ratchet wheel 97 about its axis 63. When the star wheel cam tooth, in its angular movement, passes beyond the range of shoulder 106, the push rod 95 is immediately retracted to its rearward position, by the biasing retracting spring 111, where the shoulder 106 is engaged by the oncoming succeeding star wheel cam tooth. In the meantime, the holding pawl 122 holds the ratchet wheel from rotation, while the dog 109 of pawl 107 rides up the long side 138 of ratchet tooth 110 during the rearward stroke. The pawl 107 is pivoted at 108 and the weaker spring 114 permits the pawl to rotate on its pivot 108 a sufficient amount for the dog to ride over the ratchet tooth, but when the point of the dog 109 passes the apex or crest of a ratchet tooth 110, the bevel 127 stretches the spring 114 and immediately causes the pawl of dog 109 to momentarily lift out of engagement range of the ratchet teeth and the edge 127 of the pawl solidly abuts against the edge 128 of the bridge plate 104.

When the drive rod 95 has completed its forward stroke the ratchet wheel 97 has been rotated by one ratchet tooth (angular distance). Since this represents three teeth (angular distance) through which the gear 62 and pump drive sprocket gears 47 (*a* to *k*) have travelled, this means that one volume count of colorant has been delivered from

each of nozzles 55 (*a* to *k*). Also, the index scale 130 has moved angularly one count division in a direction indicated by arrow 136 (see Fig. 1).

After the drive rod 95 has been retracted to initial starting position, it is then pushed forward again by the on-coming succeeding cam tooth on the star wheel 72. When the drive gear 72 has travelled another three teeth (angular distance), the cam tooth has driven the drive rod 95 through another forward stroke, thus driving the ratchet wheel 97 another ratchet tooth (angular distance), and the index scale 130 is moved another count division toward the zero position. Also, another volume count of colorant has been delivered from the nozzles 55 (*a* to *k*). This reciprocation of push rod 95 is continued with continued rotation of ratchet wheel 97, tooth by tooth, until the index scale reaches zero position. This is when the zero division of the scale registers with the fixed index 131. When this comes about, the cam finger 98 has been rotated with ratchet wheel 97 to a position where it engages the stem 100 of micro-switch 99 and opens this switch. This causes the motor, which preferably has a "built-in" brake, to stop instantaneously and consequently the pumps stop operation and no more colorant is delivered from the nozzles 55 (*a* to *k*). When the index scale has reached zero position, twenty-five volume counts of colorant have been delivered into the receiving can 90 and the paint and colorant may be mixed to produce the predetermined color according to formulas and charts previously worked out.

When the micro-switch is opened by cam finger 98 which depresses stem 100, the current to solenoid 152 is cut off. This results in the opening of switches 147, 155 and when switch 155 is opened current ceases to pass to motor 65 and it is immediately stopped. The motor 65 is preferably of a type which has a built-in brake. It will be seen that another cycle of operation cannot be begun except by operation of starter switch 150. So no further colorant can be pumped until the index wheel is reset to move the cam finger 98 out of engagement with the micro-switch 99.

It will be understood from the foregoing that the machine may be preset by means of index wheel 129, to deliver any predetermined quantity of colorant to a receiving vessel; that is, any desired number of volume counts within the limits of the range of the machine. And the machine may be adapted for a very wide range. Also it will be understood that the foregoing description of the embodiment in which a three-tooth movement of drive gear 62 and a three-tooth movement of sprocket gears 47 represents the delivery of a given amount of colorant, is illustrative, and it is within the contemplation of the invention that these ratios of gears and indexes and their correlations may be changed or modified to accommodate the delivery characteristics of the colorant pumps which may be different from those employed in the foregoing illustrative embodiment.

The terms and expressions which have been employed herein are used as terms of description and not of limitation, and there is no intention, in the use of such terms and expressions, of excluding any equivalents of the features shown and described or portions thereof, but it is recognized that various modifications are possible within the scope of the invention claimed.

WHAT WE CLAIM IS:—

1. A paint colorant dispensing machine which comprises a framework, an array of stationary colorant supply vessels mounted on said framework, a separate gear pump connected to each of said supply vessels, each gear pump having an intake connected with the interior of its supply vessel and a discharge outlet to which is connected a flexible delivery conduit from which colorant from that supply vessel is delivered, a rotatable pump drive shaft connected to each of said gear pumps, each of said gear pumps delivering a predetermined, fixed amount of colorant through its flexible delivery conduit for each equal angle of rotation of said drive pump shafts, and means to rotate all of said pump drive shafts in unison so that when any one of said gear pumps is rotated, colorant is simultaneously pumped through all of said conduits, said conduits providing an array of flexible conduits and each conduit having a delivery nozzle normally positioned to return colorant to the supply vessel to which its pump is connected so that colorant pumped from each supply vessel will be circulated and returned to that supply vessel when that nozzle is in normal position, said conduits being sufficiently flexible to permit any selected conduit of said array of conduits to be manually moved from its normal position to place its delivery nozzle for delivery of colorant from that conduit into a receiving vessel during the operation of said pumps while the colorant in each of said other supply vessels is simultaneously agitated by circulation of the colorant contained therein through its pump and flexible conduit.

2. A dispensing machine according to Claim 1, characterized in that a presettable counter and indicator mechanism is mounted on said framework and is connected to be operated in response to rotation of one of said drive shafts and to control the amount of angular rotation of said gear pumps upon operation of said dispensing machine.

3. A dispensing machine according to Claim 1 or 2, characterised in that the means

to rotate all of said gear pump shafts comprises a sprocket gear wheel fixed to each of said gear pump drive shafts, a sprocket gear wheel fixed to a main drive shaft, an endless sprocket chain trained over all of said sprocket gear wheels and an electric motor connected in an electric circuit to rotate said main drive shaft.

4. A dispensing machine according to any of the preceding claims characterized in that each of said gear pump drive shafts extends vertically through the supply vessel to which its gear pump is connected and each pump shaft has a stirring member attached thereto within its supply vessel.

5. A dispensing machine according to Claim 3 or 4, characterized in that the motor is connected in an electric circuit which is closed and opened in response to operation of said counter and indicator mechanism.

6. A dispensing machine according to any one of Claims 3 to 5, characterized in that said electric circuit includes an openable and closeable switch and said presettable indicator mechanism comprises a reciprocatable pawl reciprocated in response to rotation of said main shaft, a ratchet tooth wheel rotatable in response to reciprocation of said pawl, and a cam member on, and rotatable with, said ratchet tooth wheel and adapted to engage and throw said switch when said ratchet wheel is rotated and said cam member engages with said switch.

7. A dispensing machine according to Claim 6, characterized in that a star wheel having a plurality of cam teeth is fixed and rotates with said main shaft, and a push rod pivotally connected to said pawl is reciprocated in response to rotation of said star wheel to rotate said ratchet tooth wheel tooth by tooth.

8. A dispensing machine according to Claim 7, characterized in that said ratchet tooth wheel serves as a counter wheel and successive cam teeth on said star wheel engage said reciprocatable push rod at the end of its rearward strokes and pushes said rod in its forward strokes causing said pawl to rotate said counter wheel through a predetermined equal angle of rotation for each forward stroke of said push rod.

9. A dispensing machine according to Claim 8, characterized in that the pump drive shaft sprocket wheels have sixteen teeth each, the main drive shaft sprocket wheel has eighteen teeth and the star wheel has six cam teeth.

10. A dispensing machine according to Claim 9, characterized in that said push rod reciprocates in a guideway, a spring is connected to said push rod to bias said rod toward retracted position, said ratchet tooth counter wheel has a scale with a zero position and which rotates with said ratchet tooth wheel, said scale being presettable with reference to a fixed index and moving toward its zero position a given amount upon each forward stroke of said push rod and indicating the amount of colorant delivered by said pumps.

11. A dispensing machine according to any of Claims 7 to 10 characterized in that a second pawl is mounted adjacent to and engages the teeth of said ratchet tooth wheel to hold said ratchet tooth wheel fixed during the retraction stroke of said push rod.

12. A paint colorant dispensing machine substantially as hereinbefore described and illustrated in the accompanying drawings.

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Agents for the Applicants.

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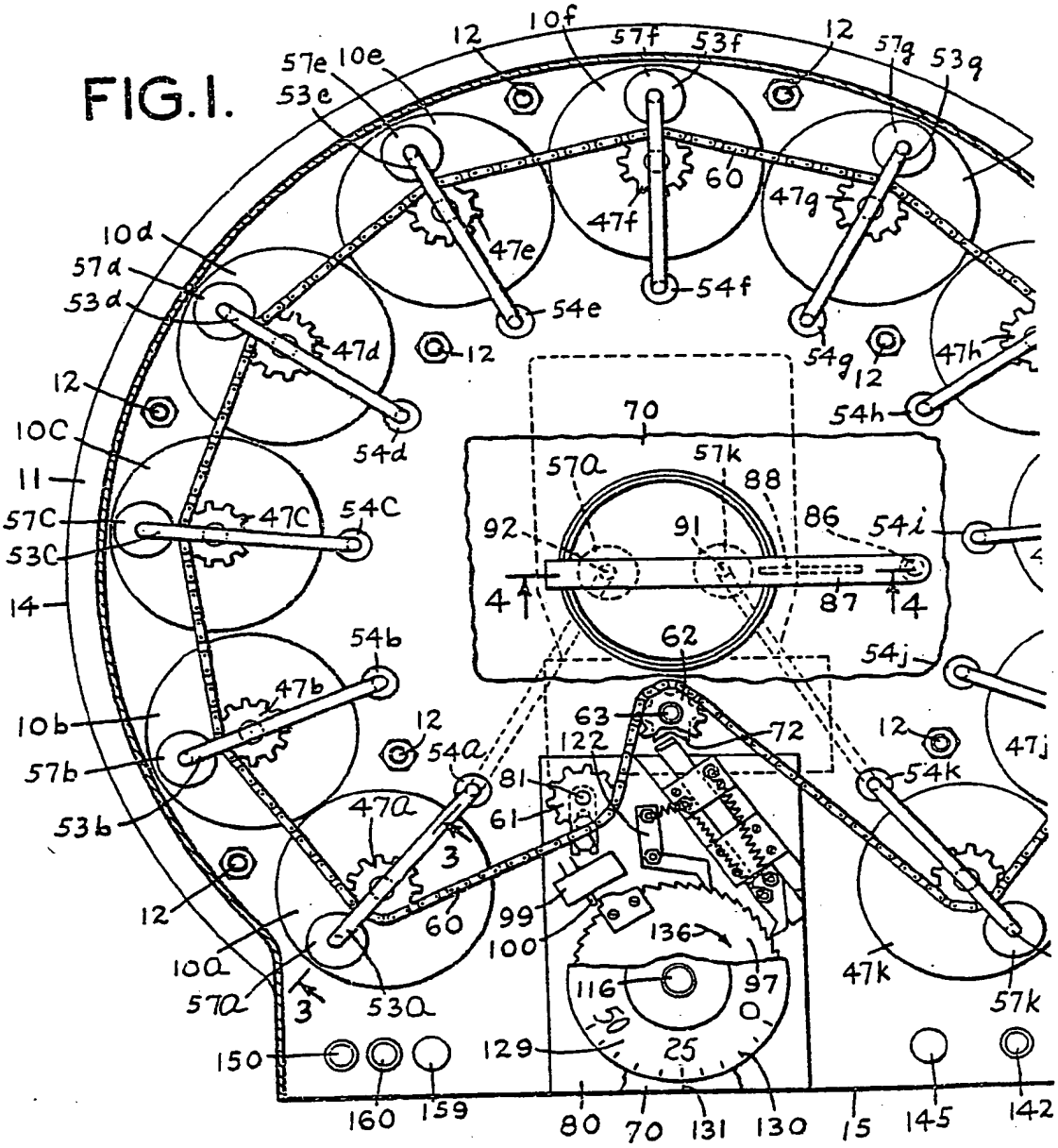
FIG. 1.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889,724 COMPLETE SPECIFICATION

4 SHEETS

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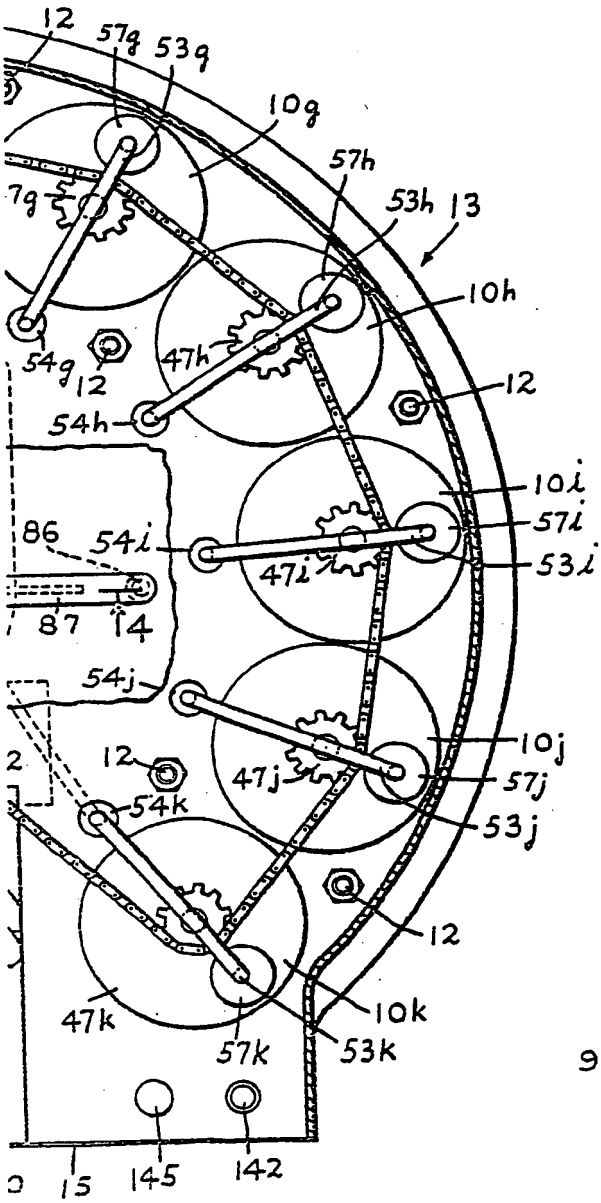


FIG.3.

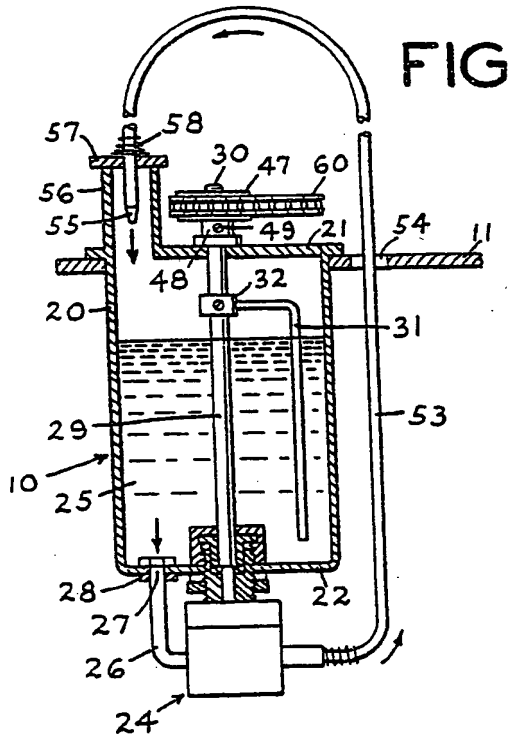
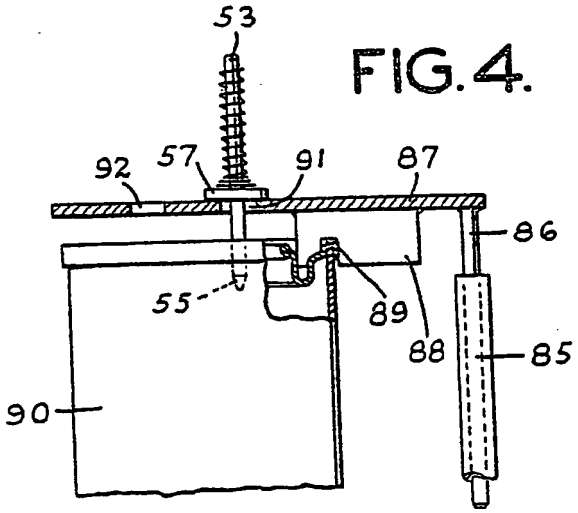


FIG.4.



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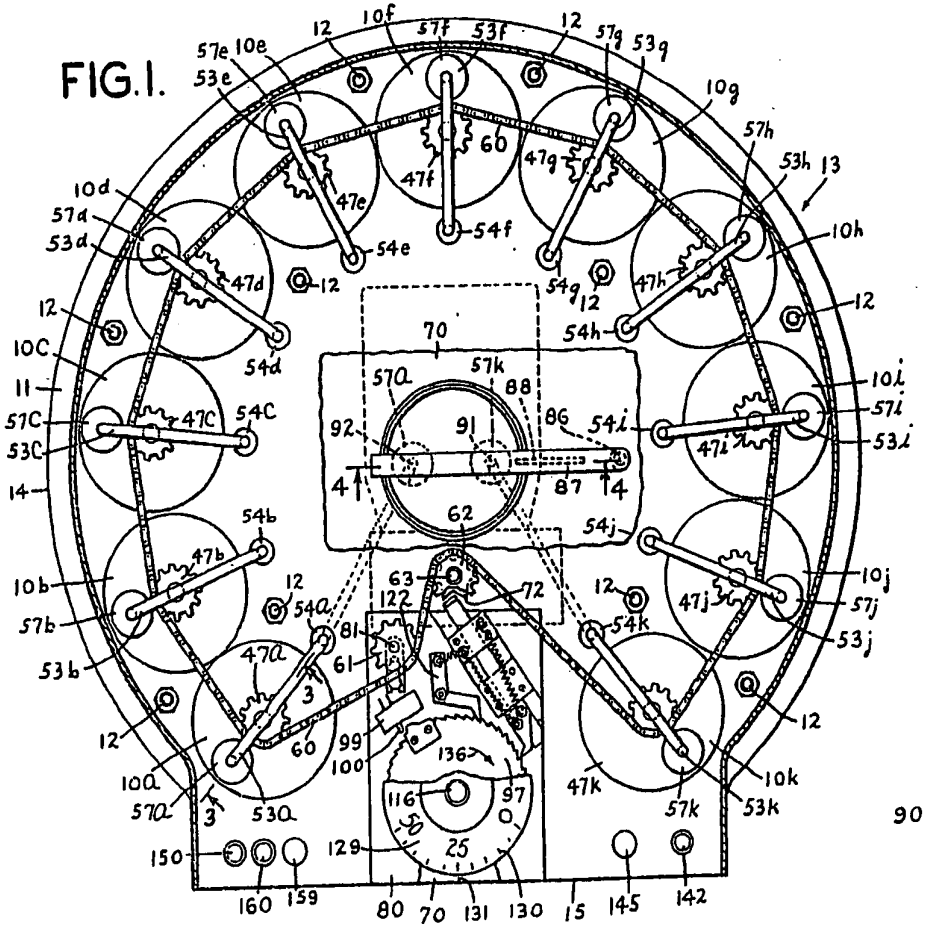
SHEET 1

FIG.1.



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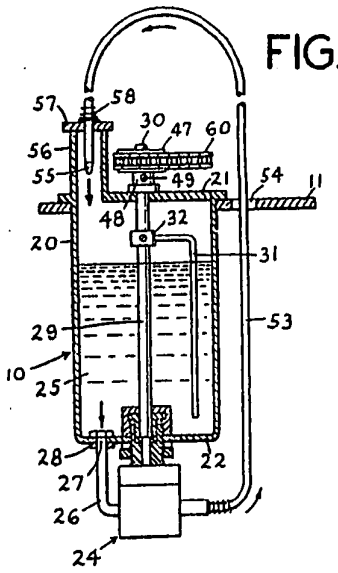

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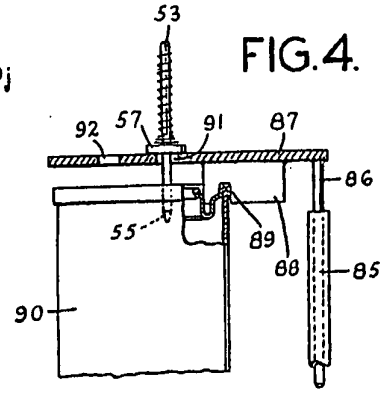
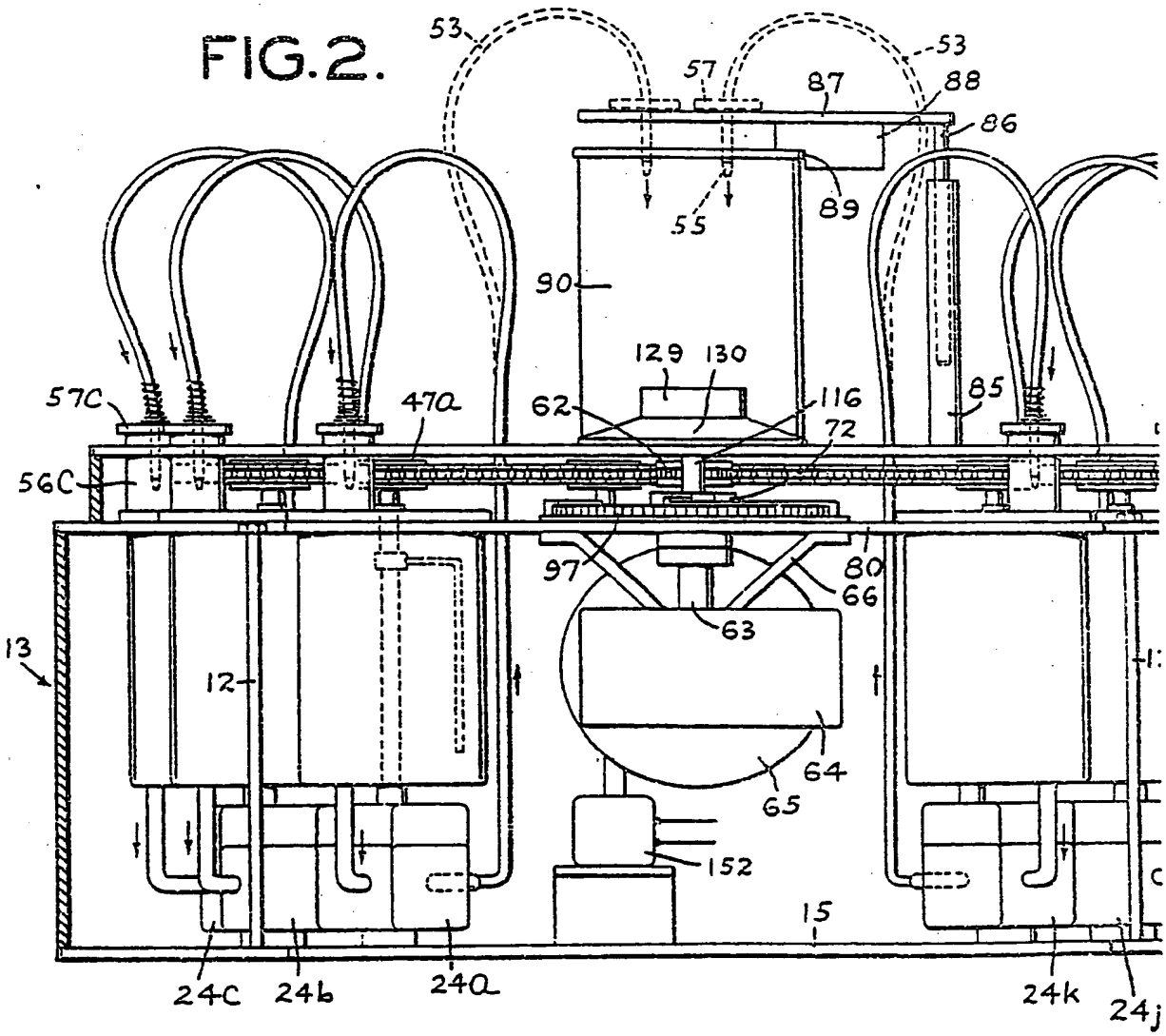


FIG.2.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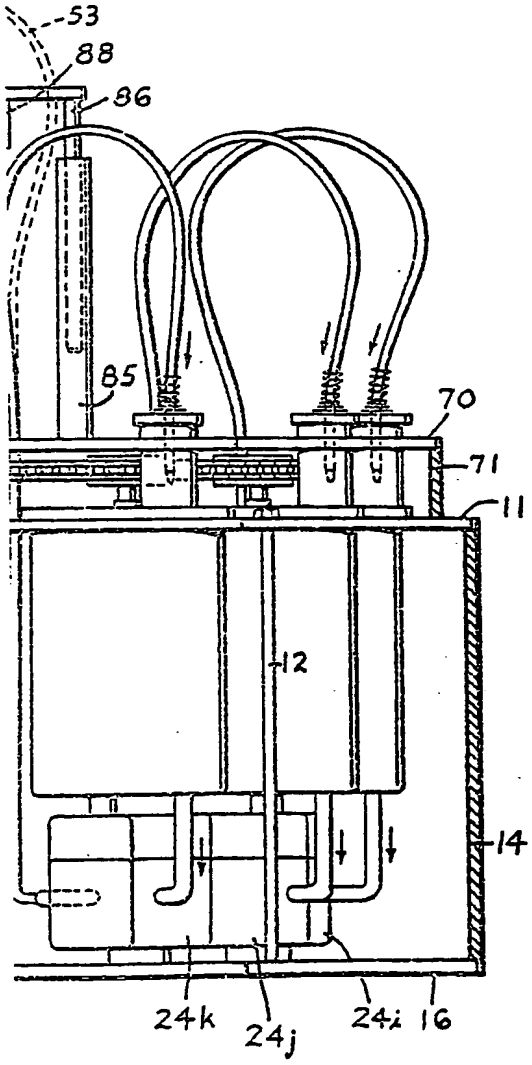
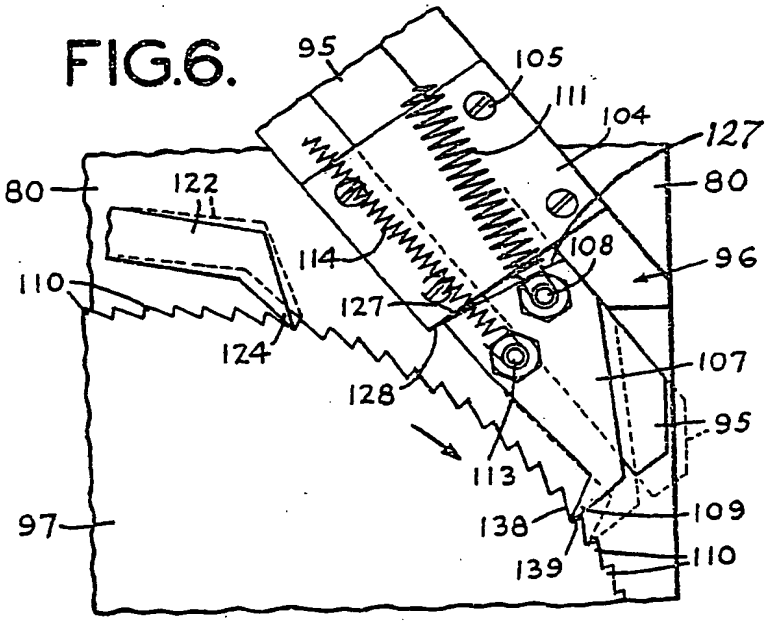


FIG.6.



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SHEET 2

FIG.2.

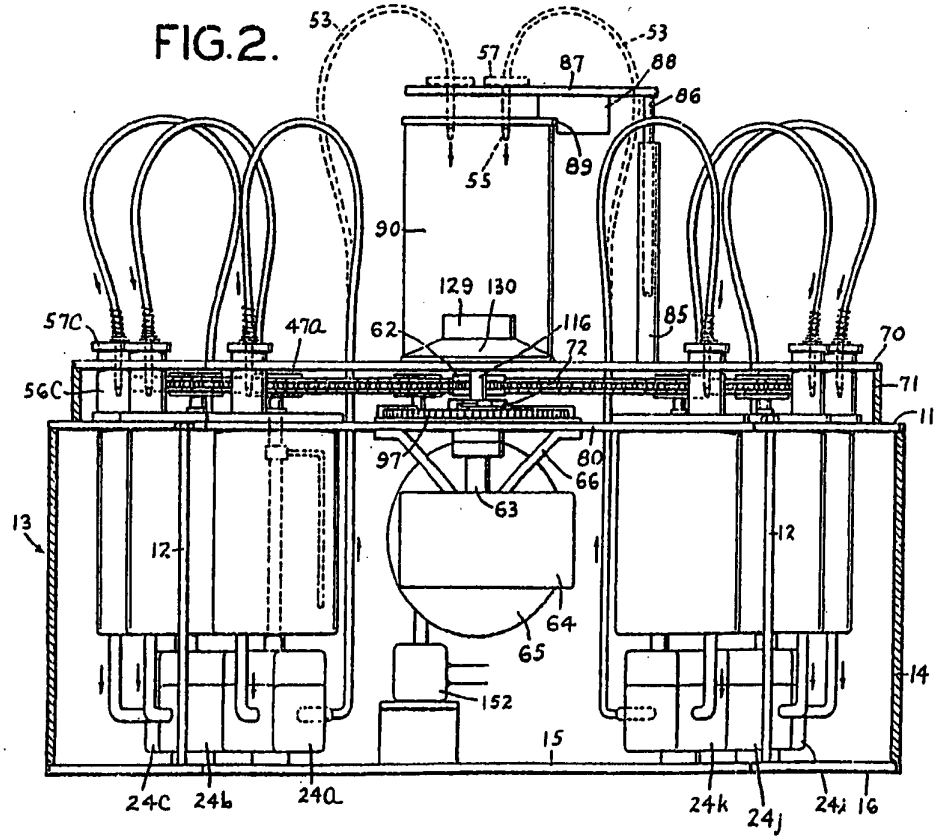
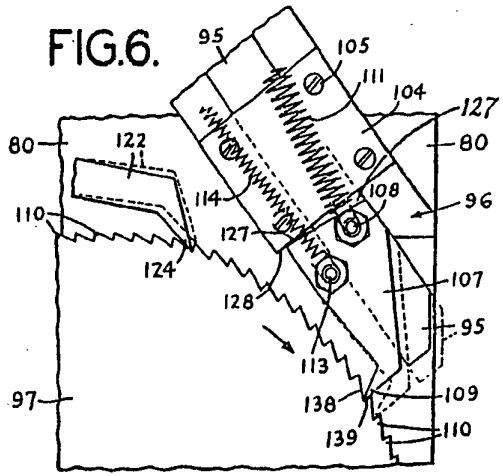


FIG.6.



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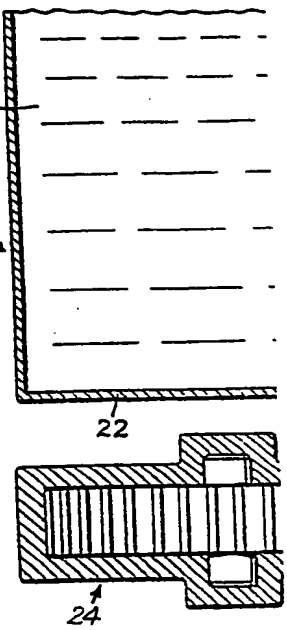
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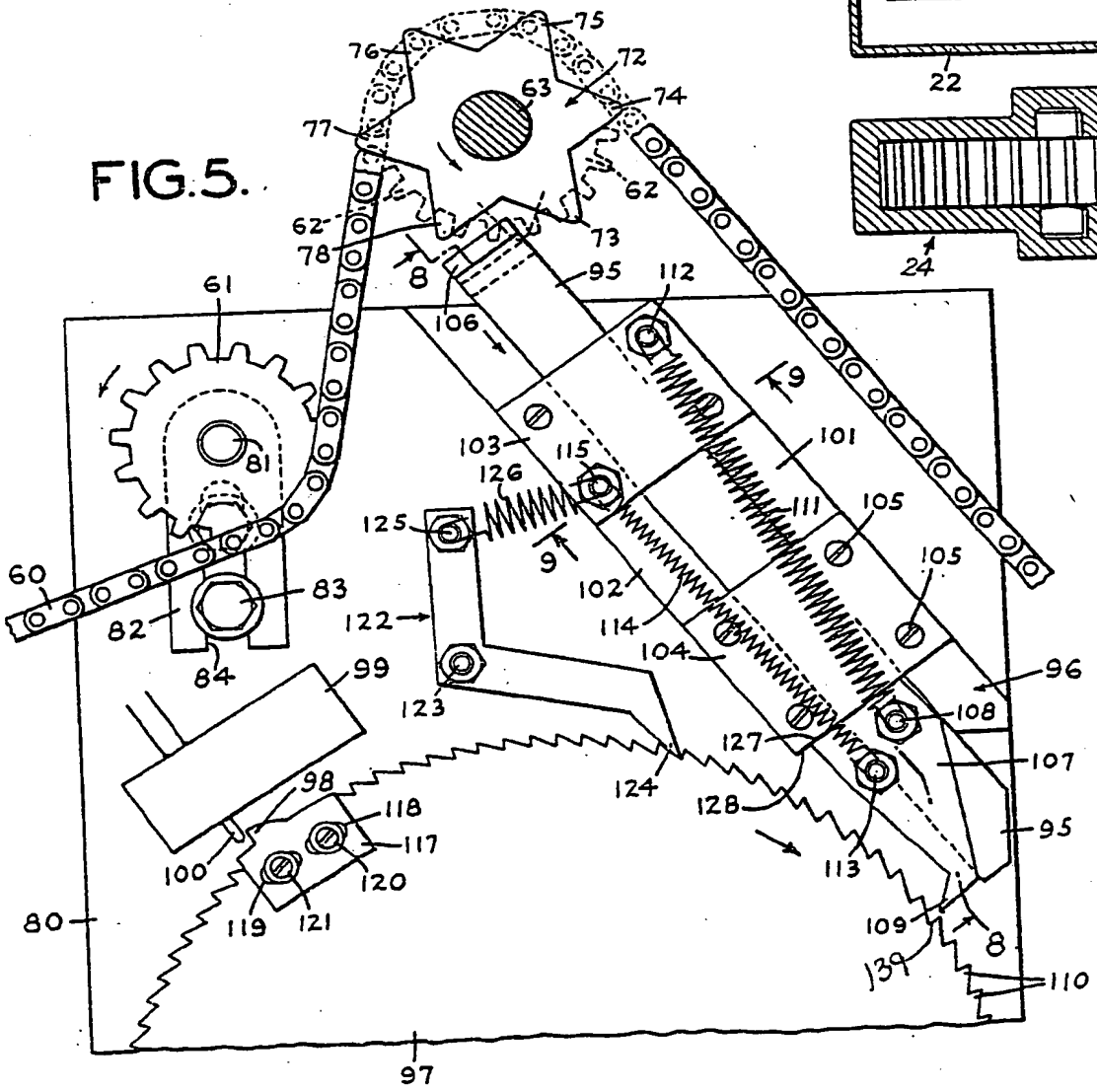
FIG.5.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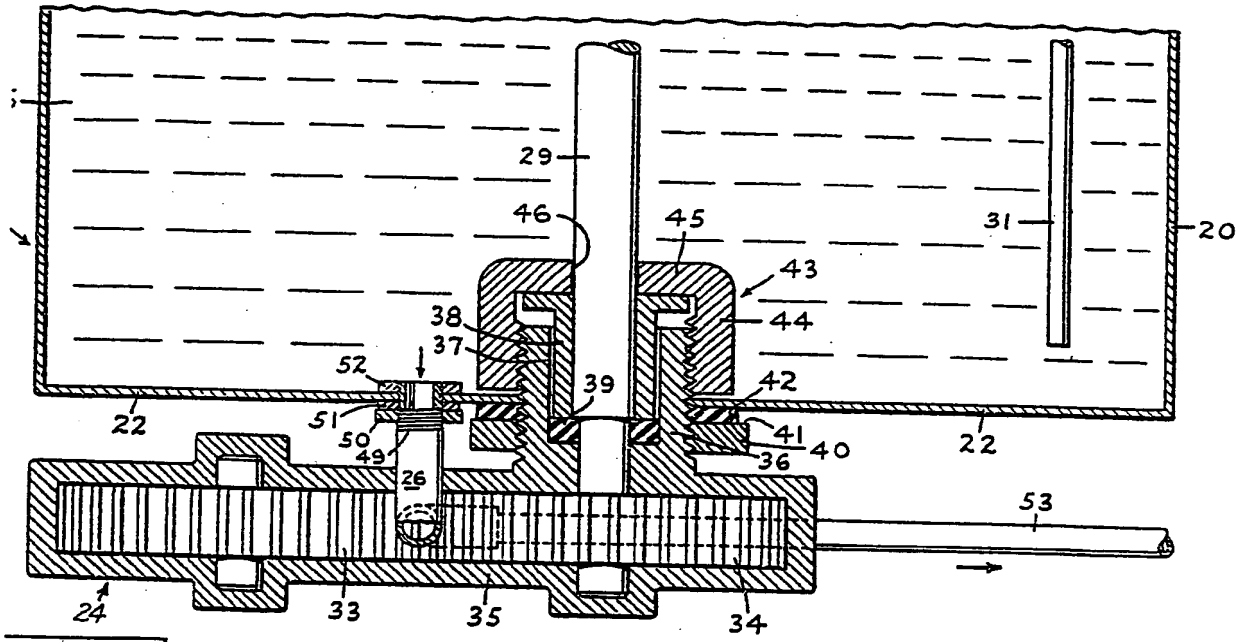
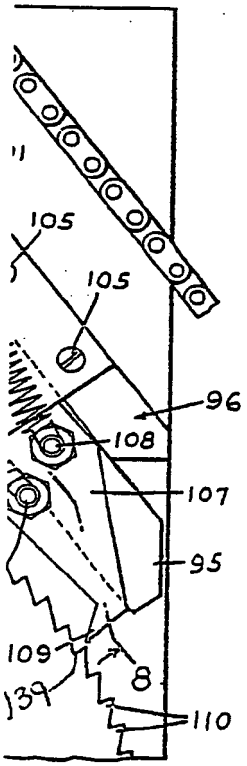
SHEET 3





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SHEET 3

FIG.7.

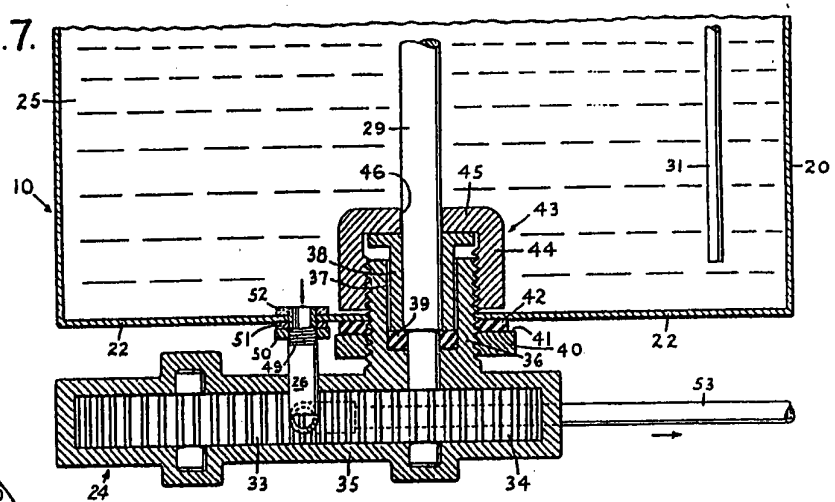
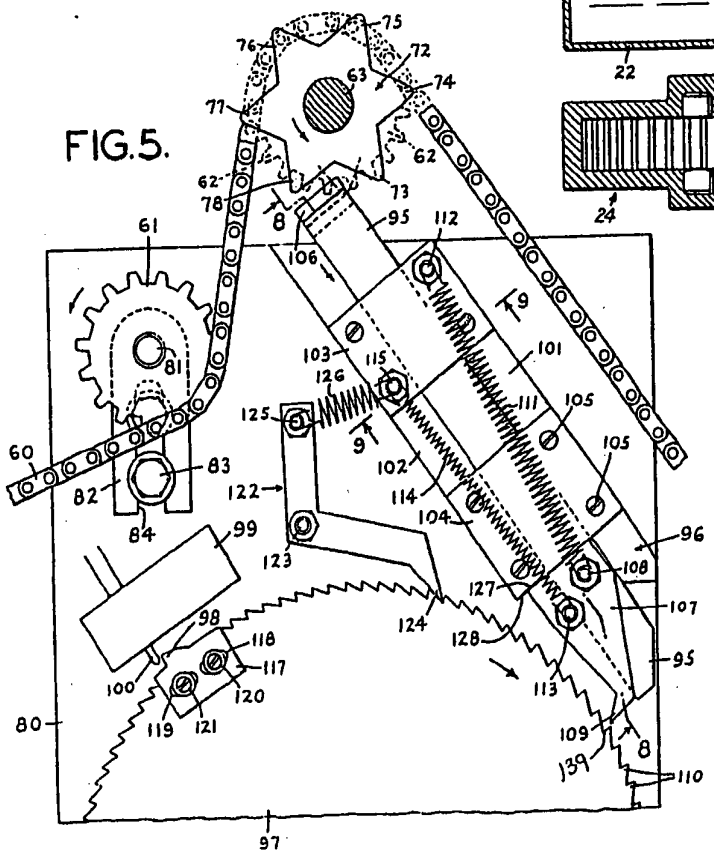


FIG.5.



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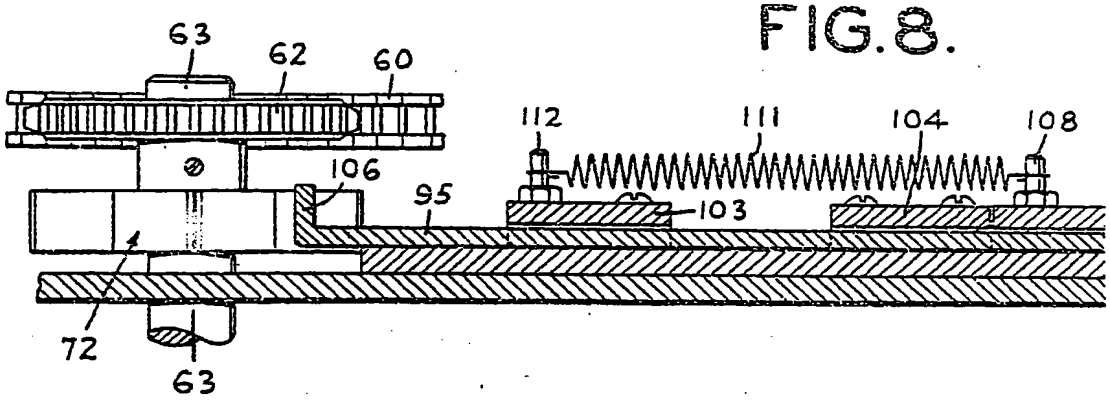
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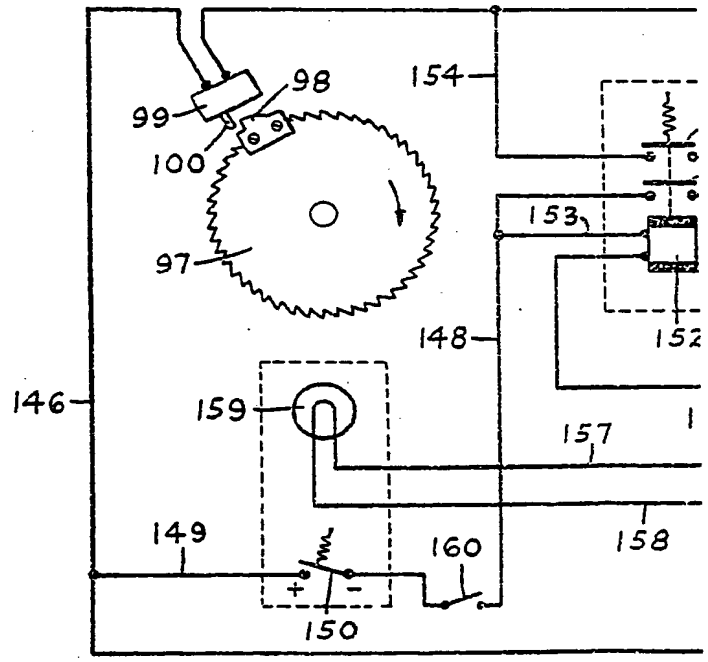
FIG.10.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889,724 COMPLETE SPECIFICATION
4 SHEETS
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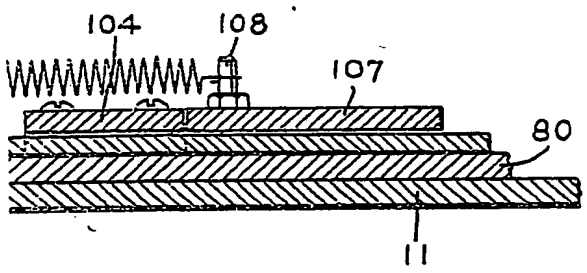
SHEET 4

IG.8.



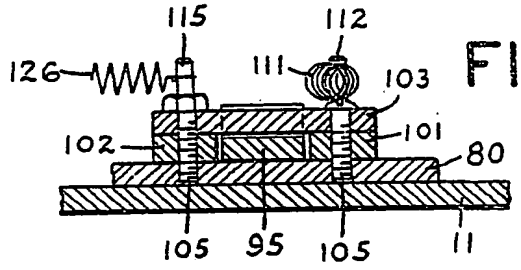


FIG.9.

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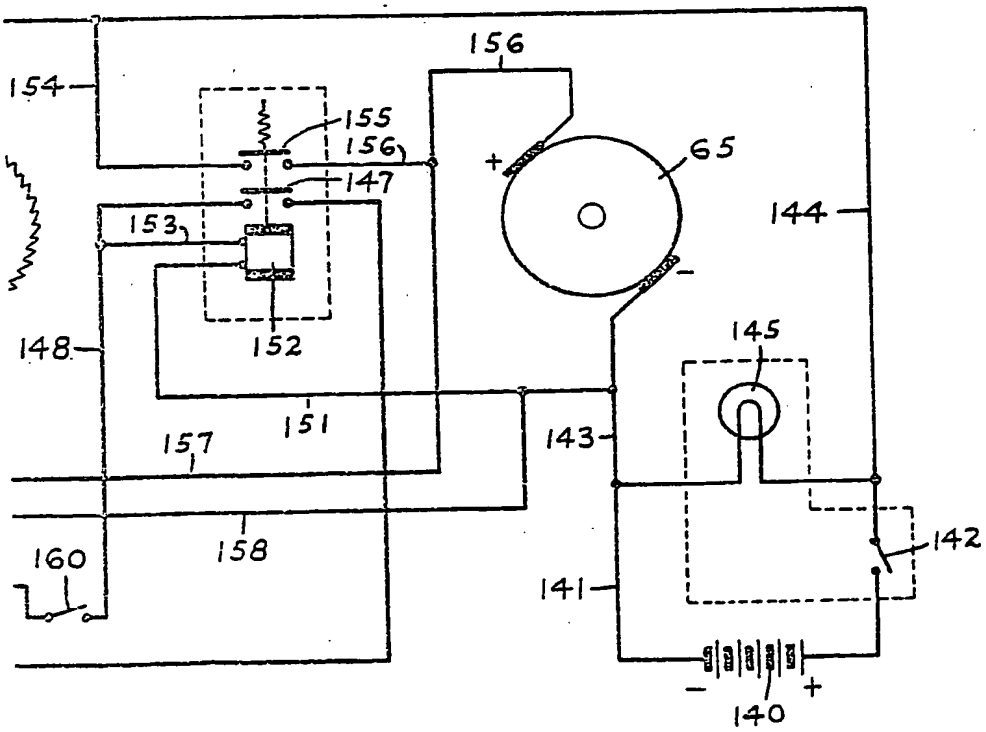

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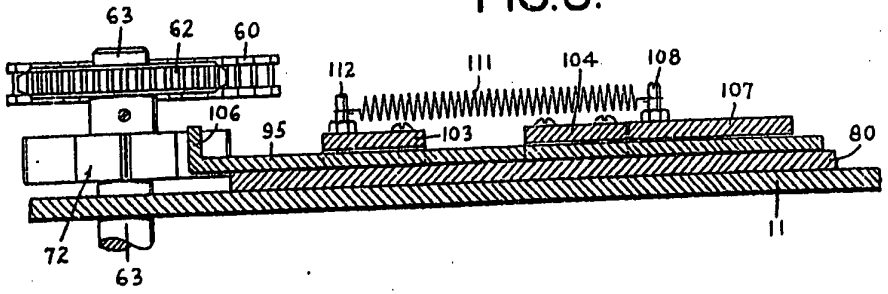
SHEET 4

FIG.8.



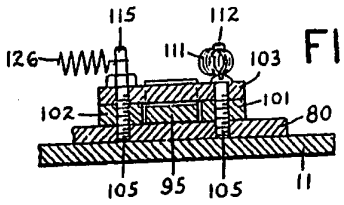


FIG.9.

FIG.10.